

BEFORE THE
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

DEPT. OF TRANSPORTATION

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Notice of Proposed Rulemaking)

Reduced Vertical Separation)
Minimum)

Docket No. FAA-1999-5925 - 7

COMMENTS OF
THE INDEPENDENT PILOTS ASSOCIATION

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Introduction

Representing over 2000 airline pilots employed by United Parcel Service, the Independent Pilots Association (“IPA”) has a primary interest in aviation safety. Our member pilots operate all-cargo flights that would be affected by the proposed rule to implement Reduced Vertical Separation Minimum (“RVSM”) in Pacific oceanic airspace. Reduced Vertical Separation *Minimum*, Docket No. FAA- 1999-5925, Notice No. 99-10 (“*RVSM Proposed Rule*”), 64 Fed. Reg. 37017 (July 8, 1999) (proposed amendment to 14 CFR Part 91).

While IPA does not object in principle to the concept of reducing vertical separation if safety is not compromised, we oppose the current proposal because it does not meet this standard. Specifically, we object to the failure of the FAA to require that all transport category aircraft utilizing RVSM be equipped with a Traffic Alert and Collision Avoidance System (“TCAS”) that is operational. Without TCAS, RVSM poses unacceptable risks to the safety of pilots, crew, passengers, aircraft and cargo.

The FAA bases its proposal on a target level of safety of no more than 5 fatal accidents per one billion flying hours. *Id.* at 3702-1. The proposal states that “One

precedent used was a period of 100 to 150 years between midair collisions.” *Id.* It is not clear how this “precedent” was established since the totality of aircraft flight is less than 100 years, and there have been many tragic **midair** collisions during this **time**.¹ Supposedly, “[w]hen the TLS [Target Level of Safety] of 5 accidents in a billion flying hours is projected in terms of a calendar year interval between accidents in the Pacific, it yields a theoretical interval of approximately 322 years between midair **collisions**.”² *Id.*

The FAA states that “The on-going assessment of risk in the North Atlantic over the past two years has shown that the TLS of 5 accidents in 1 billion flight hours can be met,” and “All sources of error related to aircraft performance and to human error have been assessed.” *Id.* at 37022. It is difficult to understand how two years’ worth of experience can be projected out into a prediction of a 322-year experience based on operating conditions that are difficult to predict over the next ten years. Moreover, as many accident investigations reveal, accidents are often caused by a series of actions, inactions, and events that are theoretically remote, if not impossible, and certainly not predicted, but that nonetheless occurred. This argues for a skeptical view of FAA’s assertion that “all factors have been assessed,” in coming up with its safety prediction.

Fortunately, there is a means available to guard against the supposedly remote -- but realistically much more likely -- possibility that two aircraft will collide in the

¹ It is conceivable, but meaningless, to include the number of midair collisions between aircraft over the last two thousand years and come up with a long average time between such accidents. The precedential value of including years in which there were no aircraft flights is less than 5 in one billion.

² FAA’s statement that “[t]he accepted level of safety is consistent with the acceptable level for aircraft hull loss . . .” (*RSVM Proposed Rule*, 64 Fed. Reg. at 3702 1), appears, perhaps unintentionally, to express more concern with economic damage than potential loss of life. IPA believes that FAA’s focus should be on saving and preserving lives, not aircraft hulls.

RVSM environment. The solution is to require that aircraft operating in the area be equipped with an operational TCAS, to serve as a safety net for aircraft crews and passengers. The safety benefits of TCAS are not merely theoretical – they are real and have been demonstrated time and again. While TCAS is not foolproof, no system is. However, it is undisputed that TCAS enhances safety, and has been credited with preventing midair collisions – exactly the type of accident that could otherwise be fostered by reducing vertical separation of **aircraft**.³

Mandating TCAS is Especially Warranted When Reducing Vertical Separation in an Environment of Increasing Aircraft Activity

Establishing additional RVSM airspace is driven by the need to accommodate increased traffic density. *Id.* at 370 18, 3702 1. Higher **traffic** density increases the chance of a mid-air collision. Requiring the use of TCAS in RVSM airspace would help ensure that the reduced vertical separation of aircraft does not compromise safety. If FAA were to adopt its proposal to reduce vertical separation without requiring TCAS and a tragic collision to occur that could have been avoided with TCAS, FAA would not be able to quell the inevitable and justified outcry from the public.

³ FAA states that RVSM enhances safety in the lateral dimension, by producing a wider distribution of aircraft among different tracks and altitudes, reducing “the number of occasions when two aircraft pass each other separated by a single separation standard (e.g. 60 nm laterally). The benefit to safety is that, should an aircraft enter, as a result of gross navigation error, onto an adjacent track, and another aircraft is on that track, there is an increased probability that the two aircraft would be flying at different flight levels.” *Id.* at 37022.

If FAA recognizes that an aircraft could, through a “gross navigation error” be 60 nautical miles off track, then it must also acknowledge that an aircraft could be 1000 feet off-track vertically. Reducing the vertical separation by **50%**, as the current RVSM proposal would do, significantly reduces the margin for vertical separation errors. As **IPA** sets forth below, there are particular circumstances concerning altimeter settings in transpacific flights that increase the possibility of such errors. FAA should therefore be vigilant in assuring that the occurrence of such errors does not result in a midair disaster.

In the Absence of Requiring TCAS, Altimeter Errors in the RVSM Environment Could Lead to Disastrous Accidents

FAA states that “Altimeter system error (ASE) is the major component of aircraft altitude-keeping performance.” *Id.* at 3702 1. Altimeter system errors include the human error of an incorrectly set altimeter, which is not uncommon. “Incorrect altimeter settings are a direct cause of altitude deviations, *some* of them severe enough *to result in near mid-air collisions* and controlled flight toward terrain.” Marcia Patten & Ed Arri, *The Low-Down on Altimeter Settings*, ASRS Directline, No. 9 at 1 (March 1997) (emphasis added) <http://www.afo.arc.nasa.gov/ASRS/dl9_low.htm>. FAA also recognizes that aircraft are sometimes mistakenly flown at an incorrect flight level. See, e.g., *RVSM Proposed Rule*, 64 Fed. Reg. at 37022 (“In this incident, an aircraft did not fly the flight level to which it was cleared, but reported to ATC that it was flying the cleared level. ”) .

“Several human and procedural factors appear to increase the possibility of misset altimeters in international operations.” Perry Thomas, *International Altimetry*, ASRS Directline, No. 2 at 2 (Oct. 1991)⁴. These factors include fatigue, workload on approach, language difficulties, communication procedure, cockpit management, and experience level and currency. *Id.* at 2-3. Many of these factors are present in operations through Pacific oceanic airspace.

Another significant factor is that aircraft entering or exiting Chinese and Russian airspace use altimeter settings measured in meters rather than feet. This requires the crew to reset the altimeters when transiting out of or into Pacific oceanic airspace, and increases the chance of error in the process of resetting the altimeter system. Many foreign countries measure barometric pressure in hectopascals, or

⁴ <http://www.afo.arc.nasa.gov/ASRA/dl2_intl.htm>

millibars, rather than inches of mercury, and aircraft crews may not be familiar with the rate of conversion between the two. See *The Low-Down on Altimeter Settings* at 5.

One report to ASRS provides this account of an approach into an Asian country:

It was the end of a long overwater flight Approach control gave the altimeter as 998 hectopascal. I read back 29.98. [The] approach controller repeated his original statement. Forgetting that our altimeters have settings for millibars and hectopascal (which I had only used once in my career, and that was 6 months ago), I asked where the conversion chart was. "Old hand" captain told me that approach [control] meant 29.98. Assuming that he knew what he was doing, I believed him. We were a bit low on a ragged approach and I knew we were awfully close to some of the hills that dot the area. . . but it was not until we landed and our altimeters read 500 feet low that I realized what had happened.

International Altimetry at 2 (ellipses and **parentheticals** in original).

Operation in the North Pacific region also includes operations by aircraft departing from airports in Alaska and Canada where extremely low altimeter settings are not unusual, due to the lower temperatures and compacting of air masses in extreme northern latitudes. There have been instances in which the departure airport altimeter setting was 28.78 and the crew reset the altimeter to 28.92 instead of 29.92 upon crossing the transition altitude. This has resulted in operations at 1000 feet below the altitude at which an aircraft was assumed to be operating, and the crew believed and reported that they were flying at the ATC-assigned altitude. In such instances, the proposed RVSM separation of 1000 feet would put an errant aircraft on a collision course with an aircraft flying in the opposite direction at that altitude.

Even in the current regime, an aircraft flying the wrong direction in international airspace has had disastrous results when aircraft were not equipped with TCAS. For instance, a German Air Force TU- 154, flying in the wrong direction at 35,000 feet off the coast of Namibia, Africa smashed into a U.S. Air Force C-141 on September 13, 1997, killing all nine persons aboard the U.S. aircraft and all 24 persons aboard the German aircraft. This tragic accident has spurred the widow of

one of the U.S. pilots to spearhead a campaign to have TCAS installed on board U.S. military transport aircraft.

The devastating loss of life from a mid-air collision between civil cargo and passenger aircraft due to the lack of TCAS is **demonstrated** by the 1996 accident between a Saudi Airlines passenger B-747 and a CIS IL-76 freighter near New Delhi, India that killed 349 people. FAA should not adopt a rule that would make such an accident more likely to occur over the Pacific. Requiring TCAS to be operational in aircraft operating within the RVSM area would help ensure that safety is not diminished by implementation of **RVSM**.⁵

There are many incidents in which flight crews report that TCAS “saved the day,” such as the following:

- On base leg. . . we were cleared by Center for [the] visual. . . Immediately after accepting the visual, Center reported pop-up **traffic** at 11-12 o'clock, level. I noticed an RA on the TCAS II with visual commands to pull up. After climbing 200 to 300 feet, I noticed a [light aircraft]. . . cross under us about 200 feet below. The alert Controller at Jacksonville Center, reinforced by the [TCAS II] RA command, . . . prevented a possible mid-air. TCAS works. Vincent J. Mellone, *TCAS II—Genie Out of the Bottle?*, ASRS Directline, No. 4 at 2 (June 1993) <<http://www.afo.arc.nasa.gov/ASRS/dl4tcas.htm>> (ellipses and **parentheticals** in original).
- Hazy holiday weekend in Southern California (LA basin). Many, many VFR aircraft in [the] area. My crew alert for traffic. TCAS scope cluttered

⁵ While FAA asserts that the level of safety in the North Atlantic and Pacific regions would be no more than five fatal accidents in 1 billion flying hours, *RVSM Proposed Rule*, 64 Fed. Reg. at 3702 1, as noted above, such infinitesimal predicted accident rates are dubious. In fact, accidents do happen even in circumstances where the statistical predictions say they shouldn't. For example, in describing the Namibia accident cited above, the Director of Civil Aviation for Namibia stated that the two aircraft that collided “were the only two airplanes over the whole south Atlantic,” and that it was “unbelievable” that they would collide – yet they did. The important fact is that TCAS is a proven and effective safety net for aircraft crew and passengers that can prevent a disaster when the scores of factors that should never occur, but sometimes do occur, would otherwise cause a midair collision. In any event, FAA should strive for the “Zero Accidents” goal of the Gore Commission, and requiring TCAS for the RVSM area would be a simple and effective way to promote this goal.

with traffic. On departure. . . climbing. . .[a] traffic conflict [at] 12:30, 3 miles, 500 to 1,000 feet above [was noted] on TCAS. I hoped to climb (zoom) above it as soon as it was acquired visually. However, it was not acquired visually until after evasive action was taken based on TCAS II RA and ATC **traffic** advisory. TCAS and ATC saved the day. Id. (ellipses and **parentheticals** in original).

- On February 6, 1999, a Federal Express **DC-10-30F** and an Air Canada **Airbus** A-320-21 1 were involved in a near mid-air collision 40 miles north of Lincoln, Nebraska. The pilot of the Air Canada flight received a **Traffic** Collision Avoidance System (TCAS) Recommended Action (RA) command to climb. The Federal Express aircraft was not equipped with TCAS. The Air Canada crew complied with the RA and executed a climb. The 14 CFR Part 121 [Federal Express] flight was operating on an instrument flight plan and was flying at 35,000 feet (FL350). The Air Canada crew had been cleared to FL350 due to turbulence. NTSB Aviation Accident/Incident Database Report, Report No. **CHI99SA090**.
- On December 6, 1998, a Delta Airlines Boeing 767 and a Caledonian Airways Lockheed **L10** 11 were involved in a near mid-air collision approximately 10 miles south of Hampton, New York at 33,000 feet (FL330) mean sea level. The Delta flightcrew received a traffic alert and collision avoidance system (TCAS) resolution alert (RA) to descend, and the Caledonian flightcrew received a TCAS RA to climb. At 0300 UTC, the two airplanes passed each other with 1.5 miles horizontal and 900 feet vertical separation. NTSB Aviation Accident/Incident Database Report, Report No. **DCA99IA0** 19.
- On its initial descent into O'Hare International Airport on June 8, 1997, a United Airlines Boeing 737 flight crew received a traffic advisory followed by a resolution advisory from the traffic alert and collision avoidance system (TCAS). The flight crew reported their altitude as being about 11,500 feet when the traffic alert was received. The first radar hit on the target airplane was at 11,200 feet. The captain executed an abrupt pull-up in order to avoid colliding with the other airplane. Investigation of the event revealed the closest separation between the two airplanes was **0.1NM** horizontally and 50 feet vertically. NTSB Aviation Accident/Incident Database Report, Report No. **CHI97LA162**.

The occurrence of midair collisions has greatly decreased for aircraft equipped with TCAS. Attachment A contains additional examples of TCAS “saves.” FAA is very familiar with the safety benefits that have been provided by TCAS, and, in fact, has cited them in the agency’s own reports to Congress. *See, e.g., Letters of Administrator David R. Hinson dated February 17, 1995 to the President of the Senate and the*

Speaker of the House; Letters from FAA Administrator David R. Hinson, dated September 26, 1994, to the President of the Senate and the Speaker of the House.

In the Pacific oceanic area where there is little or no air traffic control, and where misset altimeters may lead to operation of aircraft at incorrect altitudes, TCAS is sorely needed -- particularly if vertical separation is reduced. Misset altimeters do not affect the operation of TCAS, because TCAS operates on the standard datum plane, "blind encoders" based Mode C transponders, and local altimeter settings. TCAS will thus safeguard against the chance of human error inherent in the readjustment of altimeter systems.

Requiring TCAS Would Not be Burdensome to the Aviation Community

In many nations, aircraft are already required to be equipped with TCAS. In US airspace, TCAS is mandatory for aircraft with more than 30 seats, with a lower level of TCAS mandated for aircraft having more than 10, but less than 30, seats. As of January 1, 1999, India requires TCAS on all aircraft with maximum gross take-off weight of 30,000 lbs. or more operating in Indian airspace. This requirement was implemented after the 1996 Saudi 747 disaster cited earlier. Most western European countries have followed suit, and will require TCAS (or ACAS) in European airspace on January 1, 2000 for all aircraft with more than 30 passenger seats or weighing more than 15,500 kg (approximately 34,000 lbs.). Japan is scheduled to require TCAS in aircraft with more than 30 passenger seats or weighing more than 15,000 kg (approximately 33,000 lbs.) by January 1, 2001.

With more and more aircraft required to be equipped with TCAS, a rule requiring the equipment and operation of TCAS on all transport category aircraft in RVSM airspace would pose a minimal burden to the worldwide aviation community. US cargo aircraft currently exempted from TCAS will need to be so equipped to operate

in European airspace after crossing through North Atlantic (“NAT”) RVSM airspace. The same will be true in the North Pacific, once Japan requires TCAS in 16 months.

Indeed, in FAA’s rulemaking on NAT RVSM two years ago, one member of **ATA** indicated that TCAS should be included in the RVSM system specifications. *Reduced Vertical Separation Minimum Operations*, FAA Docket No. 28870, Amdt No. 91-254, 62 Fed. Reg. 17480, 17482 (1997) (amending 14 C.F.R. Part 91). FAA should require TCAS for all transport category aircraft utilizing Pacific oceanic RVSM airspace.

Conclusion

IPA opposes the issuance of a final rule on RVSM in Pacific oceanic airspace in the absence of a requirement that all transport category airplanes transiting this airspace be required to be equipped with an operational TCAS. Requiring TCAS to be on board and operational for all aircraft in the RVSM area would ensure that safety is not compromised by the reduced vertical separation, and would not pose a financial burden on the airlines.

NEAR MIDAIR COLLISIONS REPORTED TO NASA
AND FAA OPERATIONAL ERRORS

The following seven incidents further illustrate the need for TCAS. They are based on reports to NASA's Aviation Safety Reporting System (ASRS) or reports of FAA ATC operational errors.

1. ASRS Accession Number: 210099, date: 5/92: A freighter with no TCAS was eastbound at FL350 on radar vectors around weather in the vicinity of **Salina**, KS. FL350 is a non-standard altitude for eastbound flights. Suddenly the controller issued an immediate right turn of 30° to the freighter and the same instruction to a passenger aircraft that was approaching head-on at the same assigned altitude. These turn instructions were urgently repeated by the controller 3 times; ultimately both aircraft acknowledged and complied with the instructions. The controller also issued an **immediate** descent clearance to FL310 to the freighter. The crew had to use all their resources to accomplish this maneuver. Subsequently, both aircraft sighted each other as they passed. The controller apologized, the freighter was **recleared** to FL330 and back on course. There was a loss of standard separation and an FAA operational error was declared.

2. ASRS Accession Number: 318403, date: 10/95: This case involved a DC-10 freighter not equipped with TCAS and a VFR single engine aircraft. The DC-10 departed Newark, NJ, and was issued a turn northwest bound and a clearance to 10,000 ft. The controller issued traffic to the DC-10 as an untracked target, not being worked by the controller, at 8,500 ft. ahead and to the right of the **DC-10**.

All crew members searched for the VFR aircraft since TCAS was not installed in their aircraft. As the aircraft came closer together, the controller instructed the DC-10 to level-off at 8,000 ft. The second officer saw the VFR aircraft **first**, which prompted the captain to climb and turn right to avoid an impending collision. This evasive maneuver allowed the VFR aircraft to pass under the DC-10 as opposed to the controller's apparent plan to have it pass above the **DC-10**. The problem in this situation is neither aircraft knew where the other was until the last instant. TCAS would obtain and display this information systematically, without relying on luck in visually spotting the aircraft before disaster struck.

3. ASRS Accession Number: 243904, date: 6/93: A passenger jet aircraft was approaching Chicago (ORD) at 10,000 ft., descending, when the TCAS II equipment advised the pilots to **climb**. The crew received a TCAS alert generated by the presence of a VFR untracked target at 9,500 ft. that was climbing head-on. The crew initiated an **immediate climb**. The VFR aircraft, which was never visually spotted, passed at 9,800 ft. under the passenger aircraft, which had climbed to 10,350 ft in response to the TCAS warning.

In this case, the controller did not issue the traffic to the passenger aircraft for several reasons. The mode C intruder was not operational at the Chicago TRACON at that time and traffic advisories were prioritized lower than other controller operational duties. This is not a rare event in a high density area.

4. ASRS Accession Number: 317990, date: 10/95: This incident involved two TCAS II equipped **DC-9's** being radar vectored to the **final** approach course at Detroit Metro Airport. Aircraft #1 was descending to 4,000 ft. when the controller's radio instruction was partially blocked by another aircraft. The only part heard was "5,000". The frequency was very congested and the controller was extremely busy. Several aircraft advised the controller that his transmission was blocked, but he never acknowledged or replied to these warnings.

Aircraft # 1 received a TCAS alert to descend immediately. The crew **confirmed** the TCAS alert and visually spotted aircraft #2, another DC-9 ahead and to their left, climbing in a right turn. It is believed the blocked radio transmission was for aircraft #1 to stop the descent at 5,000 ft. to avoid the climbing aircraft. TCAS averted an accident that could have been caused by radio congestion.

5. FAA Operational Error Report # MKE-T-93-E-002: A departing BA-146 passenger aircraft was allowed to operate in close proximity to a DC-9 that was also climbing. The controller was unaware that the BA-146 aircraft had not changed to the departure control frequency and he didn't ensure that all control instructions had been received. After being alerted by their **onboard TCAS's** of an impending collision, both aircraft took evasive action. At some point, the controller's conflict alert **alarm** sounded. At the **time** of the incident, the controller was responsible for 3 aircraft.

6. FAA Operational Error Report # ZAU-C-93-E-O 11: This incident involved an MD-80 at FL330 in level **flight** and a B737 that was cleared by the controller to climb through that altitude. The controller was not aware of crossing **traffic** due to overlapping of computer generated data blocks, and the B737 was given a clearance to climb. Due to the heavy concentration of aircraft around major terminals, as is the case near Chicago, the informational data that is displayed to the controller often

overlaps, and critical information is not **immediately** available to the controller to perform his duties.

Both aircraft were alerted by TCAS and took evasive action, and the controller was alerted by conflict alert. This controller was responsible for 10 aircraft at the time.

7. FAA Operational Error Report # ZDV-C-95-E-005: This incident took place in the vicinity of Colorado Springs, CO in February, 1995 at FL270. A B727 was climbing and an MD-80 was descending. Both aircraft were equipped with TCAS and both took evasive action based on a TCAS warning.

The controller failed to recognize that the MD-80 -- which had been at **FL260**, but had deviated from that altitude -- was potential **traffic** for the climbing B727 to FL270. The controller was responsible for 15 aircraft at the time.